

Computer architecture

Sheets

Sheet (1)

Number systems

1. Convert the following binary numbers to decimal:
101110 1110101 110110100
2. Convert the following numbers with the indicated bases to decimal:
 $(2121)_3$ $(50)_7$ $(310)_5$ $(198)_{12}$
3. Convert the following decimal numbers to binary:
1231 673 198
4. Convert the following decimal numbers to the bases indicated:
a) 62 to octal
b) 198 to hexadecimal
c) 175 to binary
5. Convert the following hexadecimal numbers to octal (hint: convert to binary first):
F3A7C2 3A1B4 E2D11
6. What is the base of the numbers if the solution of the quadratic equation
 $x^2 - 10x + 31 = 0$ are $x = 5$ and $x = 8$
7. Obtain the 1's and 2's complements of the following eight digits binary numbers:
10101110 1000001 10000000 00000000
8. Perform the subtraction with the following unsigned binary numbers using the 2's complement:
a) $11010 - 10000$
b) $11011 - 1101$
c) $100 - 110000$
d) $1010100 - 1010100$
9. Represent the following numbers as binary numbers using the IEEE single precision format:
 $(+46.5)_{10}$ $(-0.000110101)_2$ $(+5.62)_8$
 $(-A.B3)_H$ $(+D2.3C)_H$ $(1.1101001)_2$

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Sheet(2)

Boolean Algebra and Combinational Circuits

1. List the truth table of a three-variable X-OR function

2. Simplify the following expressions:

a) $AB + A(CD + CD')$

b) $(BC' + A'D)(AB' + CD')$

c) $AC' + B'D + A'CD + ABCD$

d) $A(B'+C+DA')' + BC'D + (AC'+B'C+BD)'$

Complement and then simplify the expressions:

a) $A+BC+AB$

b) $AB(C'D+B'C)$

c) $A(B+C)(C'+D')$

3. Given the Boolean function: $F = x(y'z + x'y') + x + yz$

a) List the truth table of the function.

b) Write the function in sum of product form

c) Draw the logic diagram using the original Boolean expression.

d) Simplify the algebraic expression

e) Draw the logic diagram from the simplified expression.

4. Simplify the following Boolean function using three variables maps and implement the resulting function:

a) $F(x,y,z) = \sum(0,1,5,7)$

b) $F(x,y,z) = \Sigma(1,2,3,6,7)$

c) $F(x,y,z) = \Sigma(3,5,6,7)$

d) $F(x,y,z) = \Sigma(0,2,3,4,6)$

5. Simplify the following Boolean function using four variables maps and implement the resulting function:

a) $F(A,B,C,D) = \Sigma(4,6,7,15)$

b) $F(A,B,C,D) = \Sigma(3,7,11,13,14,15)$

c) $F(A,B,C,D) = \Sigma(0,1,2,4,5,7,11,15)$

d) $F(A,B,C,D) = \Sigma(0,2,4,5,6,7,8,10,13,15)$

6. Implement the function that gives an output of 1 when the inputs are (001, 011, 100, 110, 111).

7. Simplify the Boolean function F together with the don't care conditions d:

$$F(A,B,C,D) = \Sigma(0,1,2,3,7,8,10)$$

$$d(A,B,C,D) = \Sigma(5,6,11,15)$$